Section 17 - West Colorado River Basin
Water Conservation

Section 17
West Colorado River Basin - Utah State Water Plan

Water Conservation

17.1 Introduction

This section of the West Colorado River Basin Plan discusses water conservation policies, practices, measures and ideas. The discussions and presentations generally focus on conservation in residential, commercial, industrial and agricultural water uses.

Water conservation programs and policies can result in a more efficient use of existing water supplies for most municipal, commercial, industrial and

17.2 Background

Whenever water is discussed in Utah, the term conservation will most likely be included. Water is a finite resource and the demands on its use are growing. However, future water shortages in this basin will more likely be the product of long-term drought and infrastructure problems than dramatic increases in municipal and industrial (M & I) water demands. The basin is currently experiencing a slight increase in population growth. No M & I shortages have occurred so far. Considering the data presented in Section 9, M & I water shortages are not expected to occur through the year 2020.

The basin has experienced several droughts where annual water supplies have been less than 50 percent of the average annual runoff. The most notable were the drought years of the 1930s, 1961, 1977 and the early 1990s when local reservoirs were drained to record low levels. Due to these events, agricultural water users generally suffer the greatest impacts. They have taken shortages so that M&I uses could continue.

17.3 Water Conservation Opportunities

The initial and major use of water was for irrigation of agricultural crops and to support various ranching operations. Currently municipal and industrial demands are increasing. Both of these types of water users have opportunities for conservation measures.

Public awareness programs should educate consumers and also provide the educational tools necessary for children to understand and respect the value of water. Education programs are a long-term investment in our state's natural resource future, providing the tools for children to become responsible adults with a water stewardship ethic.

A well-managed conservation program for all public water uses may postpone or eliminate the need for building new facilities and finding additional supplies. The most effective program combines incentives to conserve along with conservation measures designed into the construction and operation of water supply systems.

Effective conservation programs combine activities designed to reduce the demand for water with measures to improve efficient delivery systems. Demand reduction should include educating customers on improving cropland and residential irrigation practices and landscape design. Culinary water demand reduction is also helped with a pricing schedule that provides customers an incentive to find ways to use water more efficiently. Delivery efficiency can be improved by system audits and installing new meters and other facilities to reduce measurable losses.

Water quality is important in any conservation program. If the goal is to conserve high quality water for meeting culinary growth demand, then providing a separate irrigation pipe network to substitute untreated water for lawn and garden irrigation can be a logical solution. The total amount of water may be about the same, but this saves the high cost-high quality water for culinary purposes.

17.3.1 Water Conservation Advisory Board

The 1995 publication of various water conservation recommendations by the Utah Water Conservation Advisory Board offers a number of programs and means to effectively conserve a substantial percentage of M&I water. These recommendations include: 1) Development of water management and conservation plans by major water provider agencies, 2) reduction of secondary water by replacing high water consuming landscaping with xeriscaping or landscaping with reduced water needs, 3) better overall management of water intensive businesses and large conveyance systems, and 4) implementation of incentive pricing policies.

17.3.2 Agricultural Water

Agriculture remains the largest single water use in the West Colorado River Basin; current estimates indicate irrigated agriculture diverts over 295,000 acre-feet annually. As a result, conservation programs applied to irrigated agriculture have the highest potential to conserve water.

Agricultural water users have been implementing conservation measures and facilities over the last four decades. These measures include land leveling, on-farm and off-farm ditch and canal lining, sprinkler irrigation systems, and gated pipe.

Exchanging a low-efficiency irrigation system for a more efficient one may reduce the amount of water diverted while maintaining the amount of water depleted. This will leave more water in the stream for use downstream and improve water quality. However, if the more efficient system increases crop depletion by providing a full water supply, return flows will be reduced.

Water budgets prepared during 1997-98 indicate an overall irrigation efficiency of nearly 50 percent. Current irrigation practices allow room for improvement in distribution and application efficiencies. The most widespread and effective conservation practice is scheduling irrigation based on the crop's need. This includes determining the crop consumptive use and irrigating to replenish the root-zone supply before the plant is stressed. The Colorado River Salinity Control Program will improve irrigated and conveyance efficiencies on about 36,000 acres in the Price/San Rafael area over the next 10 years (See Section 6.6)

Agricultural water conservation measures are evaluated from two stand points: one to consider the overall conveyance of water supplies from various sources to individual farms, and a second to evaluate on-farm methods of applying irrigation water to crops.

Agricultural Water Conveyance Systems - Distribution systems provide water to farms and ranches in addition to a variety of municipal, commercial and industrial water users. Open channels are the most common method of conveying water to irrigated agriculture, mostly because of low initial construction cost. Operation and maintenance costs are higher to remove weeds and debris. Excessive water loss can also be a problem resulting in poor overall water conveyance efficiencies. Seepage from open channels can be effectively managed by lining high loss sections with concrete or synthetic liners. The amount of water saved by lining may be considerable, but each case is different and must be evaluated on an individual basis.

On-Farm Irrigation Practices - Early settlers applied water to farm and ranch lands by flood irrigation or by using furrow or border irrigation. Recent studies have established the range of efficiency for all irrigation practices at a high of 90 percent to a low of near 40 percent. Irrigation efficiencies can be improved in some cases by optimizing the operation and layout of existing sprinkler or flood irrigation practices.

17.3.3 Municipal and Industrial Water

Municipal and industrial (M&I) water includes residential, commercial, institutional and industrial uses by various entities and individuals. All of these uses are supplied by culinary (potable) and secondary (non-potable) water at a current rate of about 55,000 acre-feet per year.

Culinary water use can be reduced by replacing old water using devices with new, more efficient ones; i.e., installing low flow shower heads, ultra low flow toilets, water efficient washing machines and aerators on faucets. Such devices may be able to reduce indoor water use by as much as 20 percent. More lawn sprinkling systems are being installed, but they are often operated for convenience rather than to save water. Ordinances requiring watering only between the hours of 6:00 p.m. and 10:00 a.m. have been effective in reducing water use. Reduced water use through the installation of low water-using landscapes is a good practice.

Some cities and towns have installed secondary systems to supply lawn and garden and some industrial uses with lesser quality water. Many of these systems are pipelines, but some are still open ditches.

An evaluation of water losses from municipal conveyance systems begins with an audit of existing pipelines, canals, ditches, and all related hydraulic structures and appurtenances. As field measurements have substantiated, leakage from piped distribution systems ranges from 5 percent, which is acceptable, to 20 percent where corrective action should be taken.

Water system audits effectively identify areas of excessive loss. These audits include: 1) An accounting of diversion and delivery records, 2) pressure testing of pipe systems, and 3) installation of groundwater observation wells to assess open channel seepage. This can assess overall system efficiencies, locate and determine severe losses, and provide information to develop short-and long-term system rehabilitation and water conservation programs. Annual examinations can update results of previous audits.

Xeriscape garden in Escalante

Additional conservation measures include audits of existing indoor and outdoor distribution systems, use of sprinkler and drip irrigation systems, and replacement of extensive landscaped areas with minimal water consuming shrubbery. Some areas can be graveled or hard surfaced to reduce water needs.

Institutional Water Uses - This use includes water for municipal and public recreational buildings and facilities such as schools, health care facilities, golf courses and major landscaped areas such as parks, cemeteries and athletic fields. Water consumption by these facilities accounts for about 10 percent of total M&I uses.

Irrigation of large areas such as parks, cemeteries and golf courses can be more efficient and conserve water through use of automated sprinkler systems with moisture probes. This can reduce over application of water as well as allow irrigation at night, thus reducing evaporation losses.

Residential Water - Residential uses include culinary (potable) and secondary (non-potable) water, indoor and outdoor, and are about 45 percent of total M&I uses. Potential residential water savings range from 5 percent to 50 percent in some cases.

Indoor water demand accounts for 30-40 percent of all residential uses. Indoor water use can be reduced by: 1) Conducting regular inspection of existing toilets, fixtures and plumbing; 2) replacing old high flow toilets with low flush units; 3) installing low flow showerheads; 4) taking shorter

showers; and 5) shutting off faucets while brushing teeth, minimizing flows when using kitchen garbage disposers, and by washing all dishes and clothes in fully loaded machines.

Outdoor water use for landscape irrigation accounts for 60-70 percent of all residential demands. This is supplied from either culinary or secondary water. Secondary water should be used for outdoor uses whenever feasible. This will reduce the demand for the more expensive culinary water, but it should be metered and appropriately priced.

Flood irrigation of lawns, gardens and shrubbery is inefficient and results in water loss beyond established root zones. Use of more efficient methods such as sprinkler and drip irrigation systems should be considered. The total amount of water applied per irrigation depends on the time and rate of application. Most residential users are not aware of the amount required or how much is applied. As a result, efficiencies are often low. Evaporation losses can be minimized by irrigating between the hours of 6:00 p.m. and 10:00 a.m. An example of the water savings is shown by a study in Bountiful in northern Utah. Beginning in 1991, the Bountiful Sub-Conservancy District restricted the hours of secondary watering between 10:00 a.m. and 6:00 p.m. The Division of Water Resources studied the water use in Bountiful for the 10-year period before and five-year period after the restrictions and found a 17 percent average decrease in water used after restrictions were implemented.

A significant amount of water can be conserved by making changes in residential landscaping schemes. The Utah State University Extension Service has information on low water consuming plants and vegetation. Water can be conserved by reducing planted areas or replacing existing landscaping with “hardscapes” such as decks, patios, walkways and play areas for children. Grassed areas should be designed so they are easy to care for and can be irrigated efficiently.

Other common outdoor uses include washing of vehicles, driveways, sidewalks and exterior portions of the home. These practices should be reduced as much as possible. In times of drought, outdoor water uses are the first subjected to water restrictions.

Outdoor conservation measures include: 1) Inspection and repair of outdoor plumbing; 2) use of brooms to clean driveways, sidewalks and patios; 3) elimination of continuously flowing water hoses when washing vehicles; and 4) when children are prone to leave water running, remove handles from outside hose bibs.

Commercial Water - Commercial water uses include those by small retail businesses such as grocery stores and gas stations. The largest commercial water users are restaurants, laundries, linen suppliers, hotels, commercial office buildings and car washes. In the West Colorado River Basin, commercial water use is about 5 percent of total M&I uses. Conservation measures include water audits of existing distribution and handling systems, replacement of high volume fixtures with more efficient models, recycling where possible, and reduction of high use landscaped areas.

Industrial Water - Industrial uses are about 40 percent of total M&I uses in the basin. Each industrial business or facility has its own unique process characteristics and so must be evaluated individually. Water conservation measures currently used in similar situations should be put into practice to the extent possible. Many of the water conservation measures applicable for commercial businesses apply to industry. Water audits are effective in identifying losses and should be conducted on a regular basis. Specific improvements to conserve water should be identified and implemented as part of an overall program to improve manufacturing processes.

17.3.4 Municipal Water Rates [1, 2]

Water rates may provide a strong incentive to use municipal water more efficiently. Current rates for selected cities are shown in Table 17-1.

Setting water prices to encourage more efficient use requires consideration of several principles. They are as follows:

- **A conservation price structure encourages a lower water use rate without causing a shortfall in system revenues.** To avoid

Table 17-1
Monthly Water Rates For Selected Communities

Water Supplier	Use Rate (gpcd)	Base Rate ($)/gal	First Overage		Second Overage	
			Overage Charge ($)/gal	Overage Amount (Gallons)	Overage Charge ($)/gal	Overage Amount (gallons)
Bicknell (Billed quarterly)	141	30/24k	1/k	10k	12/10k	All
East Carbon	270	12/5k	1.25/k	All		
Escalante	276	19/15k	1.50/k	10k	2/20k	
Green River	299	15/6k	2/k	All		
Helper Municipal	354	12/10k	1.45/k	All		
Lyman	151	10/10k	.80/k	All		
North Emery Water Users	136	20/10k	1/k	10k	.50/30k	All
Price City	307	29.50/6k	1.35/k	All		
Sunnyside	523	12/5k	1.25/k	All		
Teasdale SSD	399	15/40k	.50/k	20k	1/k	All
Torrey	700	10/30k	.50/k	20k	1/k	All

revenue shortages, the rate schedule should provide a base charge that is set to cover all fixed cost - those which do not vary with the amount of water delivered. It will cover all debt service, insurance, personnel, etc. which must be paid regardless of how much water is taken from the system. All customers pay this charge whether they use any water or not. Variable costs - those that do vary with the amount of water delivered - should be covered by the volume charge, or what is often called the overage rate. Revenue from this part of the rate will vary with the amount of water delivered to customers and should cover the costs of all energy, treatment chemicals, etc.

- **A conservation price structure provides for the identification of waste, rewards efficient use and penalizes excessive use**. In larger communities with more sophisticated billing and customer relations staffs, water use targets can become part of the conservation program with currently available weather station technologies, phone modems and computer billing programs. With targets in place for each customer, water over-use is readily identified, as are exemplary water efficient behaviors.

- **A conservation price structure produces excess revenues from penalty rates that can be used to fund needed water conservation programs.** Water conservation comes at a cost. This cost can be added to the commodity portion of the rate, raising the price of each gallon of water delivered to the customer's meter. Revenue generated by the conservation

portion of the rate schedule should be placed in a dedicated account and used to pay the cost of water conservation programs.

- **A conservation price structure is supported by a water bill that clearly communicates the cost of wasted water to the responsible person.** The ideal water bill would present a target usage based on weather, landscaped area and other pertinent use factors; the amount of water delivered above (or below) the target use; and the price charged for the target usage and any excess. With this information, the customer is equipped with the information needed to make intelligent choices about such things as landscape changes, spraying the driveway, washing the car, filling the pool and allowing long showers.

- **A conservation price structure is supported by a person or staff who can respond to customer calls for help in reducing water usage** . Individual home owners who desire to stay within their targets and request assistance can be visited, given a soil probe and taught to properly irrigate their lawns and gardens. Water audits for golf courses, school grounds and other large areas can be provided by trained staff personnel or by private or extension service irrigation specialists.

Water rates can be structured in several ways, each of which uphold the above principles in whole or in part. The next of three tables are used to demonstrate two common rate structures and one that is relatively new to system managers and customers in Utah. All examples bring in approximately the same revenue.

Flat rate is very simple to administer and to understand. A base charge is paid every month regardless of water use. All water delivered through the water meter is charged at a flat rate. Table 17-2 shows how this rate structure works in a hypothetical family for one year.

Increasing block rate is more complex but simple to administer if the water supplier has the proper computer billing hardware and software. Table 17-3 shows how this rate structure works in a hypothetical family for one year.

The flat and increasing block rates can be constructed to encourage efficient water use without causing a shortfall in revenue. This can be done by setting the base charge to cover fixed costs and the commodity charge set to cover variable costs.

Neither has a specific feature to identify wasteful or efficient behaviors. Under both, a water bill could be devised to show how much water is being used. A charge for each overage may encourage more efficient use. Both rate structures can be supported by a staff that responds to customer calls for help in reducing water use.

Ascending block rate is more complex. It provides a water use target for each customer based on size of landscaped area, family size and current weather conditions as measured by evapo-transpiration. Irrigation application efficiency is also accounted for in setting the targets. Table 17-4 shows how this rate structure works in a hypothetical family for one year.

17.3.5 Wastewater Reuse

Since there is only one wastewater treatment plant (Price) in the West Colorado River Basin, water reuse is not a significant source for secondary irrigation. In other regions of the United States, wastewater is routinely utilized to irrigate golf courses, landscaped strips along state and federal highways, municipal parks, and other isolated public landscaped areas.

17.4 Issues and Recommendations

The overall M&I per capita water use (potable and non-potable) in this basin is greater than the state average which makes conservation an important component for meeting future needs. One policy issue dealing with pricing is discussed.

17.4.1 Water Pricing

Issue - Public water supplier pricing rate schedules can affect water use.

Discussion - A pricing strategy may be among the most powerful conservation tools at a water utility's disposal. Cities and water districts are

finding certain rate schedules can help modify customer behavior and meet conservation goals (see Section 17.3.4). Those responsible for maintenance of large areas of turf should be billed for the cost of water, even if it is the municipality. This would bring about recognition of the cost of water.

Recommendation - The local water providers should adopt water-rate schedules that encourage water conservation. See Tables 17-2 through 17-4 for examples of water rate schedules. ●

Table 17-2
Flat Rate

Month	Usage (kgals)	Base Charge ($)	Commodity Charge ($1.10/kgal)	Total ($)
Jan	5	10.00	5.50	15.50
Feb	6	10.00	6.60	16.60
Mar	9	10.00	9.90	19.90
Apr	13	10.00	14.30	24.30
May	38	10.00	41.80	51.80
Jun	48	10.00	52.80	62.80
Jul	53	10.00	58.30	68.30
Aug	48	10.00	52.80	62.80
Sep	29	10.00	31.90	41.90
Oct	13	10.00	14.30	24.30
Nov	9	10.00	9.90	19.90
Dec	6	10.00	6.60	16.60
TOTALS	277	120.00	305.80	424.70

Table 17-3
Increasing Block

Month	Usage (1,000 gal)	Base Charge ($)	Overage ($)			Total ($)
			0 gal to 10 kgal $0.90	10 gal to 20 kgal $1.00	Over 20 kgal $1.25	
Jan	5	10.00	4.50			14.50
Feb	6	10.00	5.40			15.40
Mar	9	10.00	8.10			18.10
Apr	13	10.00	9.00	3.00		23.00
May	38	10.00	9.00	10.00	22.50	51.50
Jun	48	10.00	9.00	10.00	35.00	64.00
Jul	53	10.00	9.00	10.00	41.25	70.25
Aug	48	10.00	9.00	10.00	35.00	64.00
Sep	29	10.00	9.00	10.00	11.25	40.25
Oct	13	10.00	9.00	3.00		22.00
Nov	9	10.00	8.10			18.10
Dec	6	10.00	5.40			15.40
TOTALS	277	120.00	94.50	58.00	145.00	416.50

Table 17-4
Ascending Block

Month	Usage (kgals)	Base Chg. ($)	Target use (kgals)	ET In.	Discount @ $.83/ Kgal	Conserve use @ $1.10/Kgal	Inefficient Use @ $2.20/Kgal	Wasteful Use @ $4.40/Kgal	Irres. Use @ $8.80/Kgal	Total ($)
Jan	5	10.00	11	0	4.13					14.13
Feb	6	10.00	11	0	4.95					14.95
Mar	9	10.00	11	0	7.43					17.43
Apr	13	10.00	26.0	4	10.73					20.73
May	38	10.00	35.84	6.67		41.80				51.80
Jun	48	10.00	41.85	8.30		46.04	13.52			69.56
July	53	10.00	45.17	9.20		49.69	17.22			76.91
Aug	48	10.00	41.85	8.30		46.04	13.52			69.56
Sep	29	10.00	29.69	5		32.65				42.65
Oct	13	10.00	26.00	4	10.73					20.73
Nov	9	10.00	11	0	7.43					17.43
Dec	6	10.00	11	0	4.95					14.95
TOTALS	277	120.00	301.40	45.47	50.35	216.22	44.26			430.88

Days in Billing Period = 30 Application Efficiency = .65 Indoor use = 75 gpcd
Irrigated Area = .21 ac. Family Size = 5